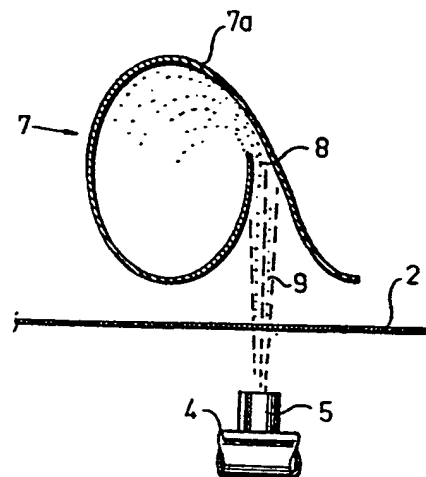
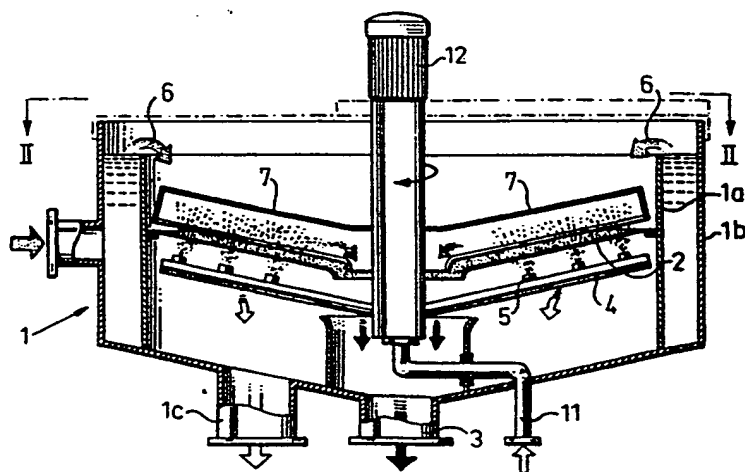




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : B01D 29/68	A1	(11) International Publication Number: WO 91/12870 (43) International Publication Date: 5 September 1991 (05.09.91)
(21) International Application Number: PCT/SE91/00158 (22) International Filing Date: 27 February 1991 (27.02.91) (30) Priority data: 9000722-0 28 February 1990 (28.02.90) SE (71) Applicant (for all designated States except US): FILTER-TEKNIK B.W. AB [SE/SE]; Box 3065, S-161 03 Bromma (SE). (72) Inventor; and (75) Inventor/Applicant (for US only) : WICKZELL, Björn [SE/SE]; Lärftvägen 7, S-178 00 Ekerö (SE). (74) Agents: WENNBORG, Göte et al.; Kransell & Wennborg AB, Sandhamnsgatan 42, S-115 28 Stockholm (SE).		(81) Designated States: AT (European patent), BE (European patent), BR, CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FI, FR (European patent), GB (European patent), GR (European patent), IT (European patent), LU (European patent), NL (European patent), NO, SE (European patent), US. Published With international search report.

(54) Title: A METHOD AND APPARATUS FOR FILTERING A PARTICLE-LIQUID SUSPENSION



(57) Abstract

In a method of filtering particle-contaminated liquid delivered to the upper side of a filter (2) which coats with an outlet (3), spray pipes (4) equipped with nozzles (5) and rotatably mounted beneath the underside of the filter direct jets of flushing liquid onto the filter. Mounted above the filter surface at a distance therefrom is a drainage channel (7) by means of which parts of the particle-containing liquid is collected and conducted to the outlet. The drainage channel has an extended part which forms a

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A method and apparatus for filtering a particle-liquid suspension

5 The present invention relates to the filtration of liquid/particle suspensions, and more particularly, but not exclusively to a method of filtration according to the preamble of Claim 1.

10 Filters of the kind to which the invention pertains are intended, for instance, to purify and clarify hot and cold process water and untreated water mechanically. Filters of this kind are in the paper and cellulose industry as a spray water filter among other things, in order to prevent clogging of the spray tubes. Typical
15 applications in this respect include the treatment of circulating scrubber spray water, the treatment of water from the press section of a paper machine, and sealing water from vacuum pumps. Other areas in which such filters are used include the purification and
20 clarification of sea and river water intended for use as fabrication water and cooling water within the process industry, the iron and steel industry, power generating plants and waterworks.

25 The present invention also relates to a filter arrangement, preferably a flat filter arrangement, and more specifically, but not exclusively, to a filter arrangement of the kind defined in the preamble of Claim 4.

30 Background Art

SE,B,389.614 (Ellilä) describes a circular flat filter, having an annular filter surface which slopes from the periphery of the filter down towards the centre thereof, wherein liquid to be filtered passes from the
35 periphery of the filter surface to an outlet. Mounted

beneath the filter surface is one or more nozzle-equipped pipes which deliver filter-flushing liquid to the filter surface and which rotate together with a flushing-liquid supply pipe located in the centre of the filter. The nozzle orifices of the spray tubes are directed obliquely in relation to the longitudinal extension of respective spray tubes.

SE,B,153.533 (Engströms Mek. Verkstad) describes a similar flat filter, in which part of the particle-contaminated liquid is flushed away and collected and passed to an outlet via a drainage channel positioned above the filter surface, this channel being defined by a filter cover and the filter surface.

In principle this solution implies that a jet of liquid "brushes" particles away from the filter gauze or filter surface sideways towards an outlet located on one side of the filter gauze (in essence, similar to washing a garage floor with the aid of a water hose). The drawback with this solution is that particles will still block a substantial part of the filter during their movement towards the outlet. This prevents the whole of the filter surface from being used effectively for the purpose intended, namely to extract particles from the particle-contaminated liquid by filtration.

Further examples of the present standpoint of techniques are found in SE,C,194.216 and SE,C,204.133 (both Ellilä).

When the liquid delivered to the filter contains large quantities of fibres, the liquid will drain-off very slowly, since the fibres will block the holes in the filter, or screening gauze, even when the fibres are

moved towards the centre of the filter by the cleaning jets.

Object of invention

5 The object of the present invention is to provide a method and an arrangement of the aforescribed kind which will avoid the blockaging of the filter gauze or filter cloth that occurs in earlier known filtering methods and filter arrangements, and therewith increase
10 the effective capacity of the filter and enable larger quantities of liquid to be filtered per unit of time.

Disclosure of the invention

15 These and other objects are fulfilled by the inventive method, which has the characteristic features set forth in the characterizing clause of Claim 1.

Because particles and flushing liquid are captured and conducted to the outlet through the medium of a separate drainage channel located above the filter surface
20 and spaced therefrom, a major part of the filter gauze will be exposed so as to enable a larger quantity of particle-contaminated liquid to be delivered to the process, i.e. the filtering operation gives a greater
25 yield.

In addition, the drainage channel will ensure that the particle-carrying flushing liquid captured in the channel is conducted directly to the outlet. The invention thus affords a synergistic effect which results in
30 improved filter capacity, i.e. it enables larger quantities of particle-contaminated liquid to be filtered than was previously possible.

Alternatively, the same quantity of liquid may have a higher concentration of particles or fibres than has hitherto been possible.

5 Hitherto, the capacity of a filter has been determined by the mesh size of the filter gauze or like filter cloth and by the quality of the liquid. For instance, when filtering scrubber water deriving from a drying machine and having a fibre consistency of up to about
10 20 mg/l, the normal capacity of the filter is reduced by about 25%. When filtering white water containing fibres in a consistency of about 100 to 400 mg/l there is chosen a filter gauze having a larger mesh size and the normal capacity is assumed to be reduced by about
15 50%.

Such reductions in filter capacity are avoided when practising the present invention. Instead, a substantial increase in filter capacity is achieved, even in
20 those cases which are considered difficult or problematic from the earlier standpoint of techniques.

The invention can be applied with particular benefit to various types of flat filter, although it may also be
25 used in other types of filter.

Although the filter gauze is normally stationary and the spray tubes or pipes movable, for instance axially displaceable or rotatable relative to the filter gauze
30 the invention can also be applied in those cases where the filter gauze is movable and the spray tubes are stationary.

In practice, it is preferred that the flushing liquid
35 which takes-up the particles is delivered to the chan-

nel through an opening defined between the channel and a part which partially covers said channel and forms a splash-guard. This will ensure that the greatest possible quantity of particle-removing flushing liquid will be conducted into the channel and that as little liquid as possible will splash back onto the filter, particularly when those parts on which the flushing liquid impinges exhibit gently rounded surfaces.

10 When the invention is applied to a circular flat filter, it is preferred to use two radially extending and downwardly sloping drainage channels, these channels preferably being located in the same diametric plane as the filter.

15 According to another aspect, the invention relates to a filter arrangement, preferably a flat filter arrangement, of the kind set forth in Claim 4. Advantageous developments of this arrangement are set forth in
20 Claims 5-8.

The invention will now be described in more detail with reference to a number of exemplifying embodiments thereof illustrated in the accompanying schematic
25 drawings.

Brief description of the drawings

Figure 1 is a sectional view of a circular flat filter provided with an arrangement according to the invention.
30

Figure 2 is a top view of a filter unit according to Figure 1, with the unit removed from a unit housing and part of the filter gauze being shown in hatch.

Figure 3 is a principle drawing which illustrates a filter gauze, a drainage channel located above the
35

gauze, and an underlying spray nozzle.

Figure 4 illustrates a modification to the embodiment illustrated in Figure 3.

5 Description of embodiments at present preferred

10 In Figures 1-3 the reference numeral 1 identifies a container or housing comprising an inner housing 1a and an outer mantle 1b. The housing 1 has arranged therein a circular flat filter, by which is meant a filter
15 having flat filter surfaces, comprising a filter gauze or filter cloth 2 the filter surface of which slopes down to form a truncated cone, the outer periphery of which extends to the region of the inner wall of the housing 1, and the inner part of which terminates at a
20 distance from a central outlet 3. Mounted beneath the filter gauze 2 are spray tubes or pipes 4, which extend parallel with the filter surface and which are connected to a delivery pipe 11 mounted in the outlet 3. The spray pipe 4 is rotated at the desired speed, by
25 means of an electric motor 12.

30 The illustrated filter arrangement includes two spray pipes 4, although it will be understood that this number can be varied. Each of the spray pipes 4 is fitted with a nozzle 5, which directs jets of flushing liquid onto the undersurface of the filter gauze 2.

35 The housing 1 also includes an outlet 1c, and inlets for particle-contaminated liquid to be filtered, these inlets being shown by arrows 6. In the illustrated embodiment, these inlets have the form of spillways located between the inner housing 1a and the outer mantle 1b.

Arranged above the filter gauze 2 are two diametrically opposed drainage channels 7 which are inclined to the horizontal plane at the same angle as the filter gauze 2 and the bottoms of which channels are thus located at a constant distance from the filter gauze.

Figure 2 illustrates a meshed part of the filter gauze 2, where the mesh size may vary within wide limits, depending on the nature of the liquid to be filtered.

Figure 2 also illustrates spray pipes 4 having a central bearing 4a and holes for the spray nozzles 5.

The drainage channel 7 may have the principle configuration illustrated in Figures 3 and 4 respectively. An extended part 7a of the channel 7 extends upwards and downwards in a gentle bend, such as to cover the channel while forming an opening 8. The nozzles 5 deliver a jet 9 of flushing liquid under pressure onto the under-surface of the filter gauze 2, and particles gathered by the flushing liquid 9 will be moved into the opening 8 of the channel and there collected for transportation to the centrally arranged outlet 3 (cf Figure 1). Some of the particles on the filter gauze 2 may not accompany the flushing liquid, but instead be moved stepwise towards the central part of the filter, where these particles also depart through the outlet 3.

In the case of the embodiment illustrated in Figure 2, two drainage channels 7 extend in mutually adjacent and mutually parallel relationship with one another and have a common inlet 8. Arranged centrally in the part 7a covering the channels 7 is a liquid impingement edge 7b which is located centrally opposite the inlet 8 and which divides the particle-collecting flow of flushing

liquid such that approximately half of this flow will fall into respective channels 7.

5 The part 7a covering respective channels also functions as a splash guard and ensures that the least possible part of the flushing liquid collecting said particles will splash back onto the filter. In the Figure 3 embodiment, the part 7a has gently rounded surfaces, which contribute to the aforesaid effect.

10 In the Figure 1 embodiment, the two drainage channels 7 slope down in the same diametric plane, perpendicular to the filter through its geometric axis. The filter, however, may include additional drainage channels and
15 these channels need not necessarily be arranged symmetrically.

The filter gauze is comprised of a suitable material, for instance steel or a synthetic material. As before-
20 mentioned, the mesh width of the filter gauze may vary within wide limits and is contingent on the nature of the liquid to be filtered.

25 In the illustrated embodiments, the filter 2 is inclined slightly to the central outlet 3. The invention, however, can be applied to other types of filters, for instance filters in which the filter surfaces are truly horizontal.

30

35

Claims

- 5
1. A method of filtering particle-contaminated liquid which is delivered to the upper side of a filter onto the undersurface of which jets of liquid are delivered through nozzle-equipped spray pipes which are movable
- 10 in relation to the filter, such as to flush the filter clean and facilitate transportation of the particles to an outlet, c h a r a c t e r i z e d by collecting at least a part, and preferably the major part, of said particles influenced by the pressure of the flushing
- 15 liquid jets, together with the flushing liquid, and conducting said particles and said liquid to the outlet through a drainage channel which slopes towards said outlet and which is located above the filter surface at a distance therefrom.
- 20
2. A method according to Claim 1, c h a r a c - t e r i z e d by delivering the particle-collecting liquid to the channel through an opening defined between said channel and a part which covers said channel
- 25 partially and which functions as a splash guard.
3. A method according to Claim 1 or 2, in which the filter is a circular flat filter having an annular filter surface which slopes down towards the centre
- 30 where the outlet is located, and in which the nozzle-equipped spray pipes located beneath the filter surface rotate together with a flushing-liquid delivery pipe located in said centre, c h a r a c t e r i z e d by leading the particle-collecting flushing liquid towards
- 35 the outlet through two or more, radially extending

drainage channels, preferably pairs of drainage channels, which slope downwardly in the same diametric plane as the filter.

5

4. A filter arrangement, preferably a flat filter arrangement, comprising

- a) a filter gauze or screening gauze (2),
- b) an outlet (3),
- 10 c) means for supplying particle-contaminated liquid to be filtered onto the upper surface of the filter gauze (2),
- d) one or more spray pipes (4) equipped with nozzles (5) and located beneath the filter surface (2), these
- 15 spray pipes being connected to a delivery pipe (11) and functioning to direct jets of flushing liquid onto the undersurface of the filter gauze (2), and
- e) means (12) for effecting relative movement between the spray pipes (4) and the filter gauze (2),
- 20 c h a r a c t e r i z e d by a drainage channel (4) which slopes towards the outlet (3) and which is located above the filter surface (2) in spaced relationship therewith, said channel functioning to collect flushing liquid and to deliver said liquid to the
- 25 outlet (3) together with the particles influenced by the pressure of the liquid jets (9) and collected by said liquid.

- 5. An arrangement according to Claim 4, c h a r a c -
- 30 t e r i z e d by a part (7a) which partially covers the drainage channel (7) and which functions as a splash guard; and in that said part (7a) defines together with the channel an opening (8) which guides the particle-collecting flushing liquid into said channel.

35

6. An arrangement according to Claim 4 or 5, in which the filter gauze (2) is inclined to the outlet (3), c h a r a c t e r i z e d in that the drainage channel (7) is inclined substantially at the same angle as the filter gauze (2) in relation to the horizontal plane.

7. An arrangement according to any one of Claims 4-6, in which the filter is a circular flat filter having an annular filter surface (2) which is inclined towards the centre where the outlet (3) is located, and in which the nozzle-equipped spray pipes (4) located beneath the filter surface are intended to rotate together with a flushing-liquid delivery pipe located in said centre, c h a r a c t e r i z e d in that two drainage channels (7) extend radially above the filter surface (2) in spaced relationship therewith, preferably in a common perpendicular plane to the filter through the geometric axis thereof.

8. An arrangement according to Claim 7, c h a r a c t e r i z e d in that two drainage channels (7) having a common inlet (8) extend in mutually parallel and adjacent relationship; and in that an impingement edge (7a) or like device is arranged opposite the central part of the inlet such as to divide the particle-collecting flow of flushing liquid impinging on said edge between the two channels (7).

Fig.1

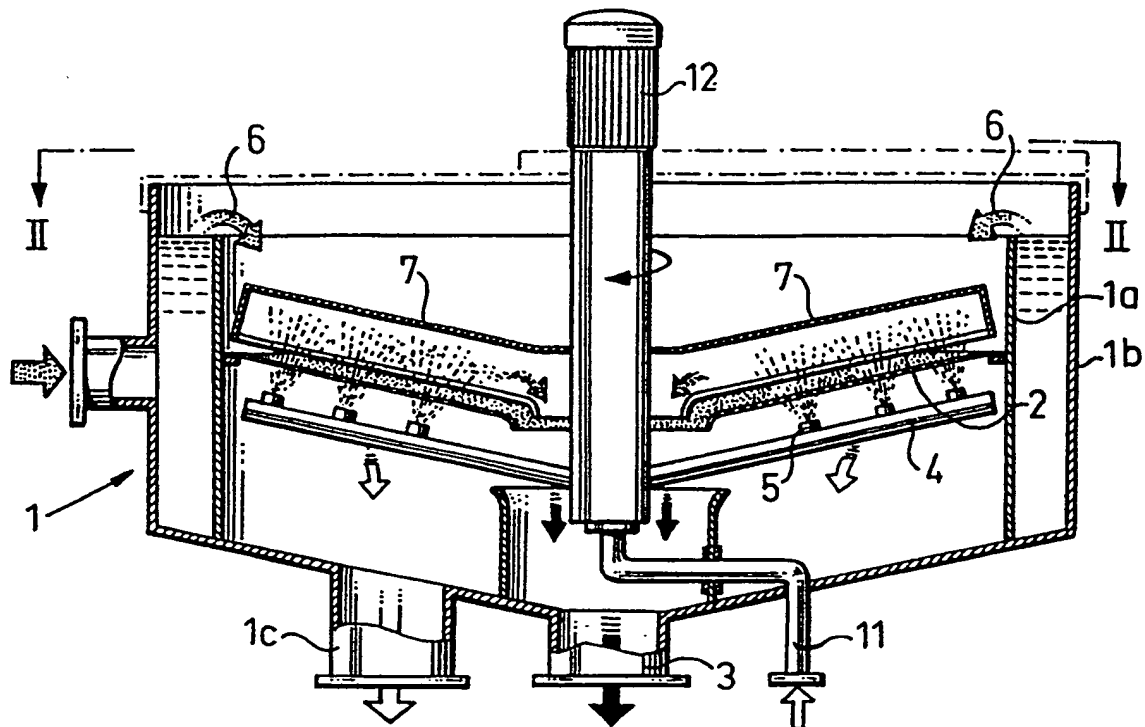


Fig.2

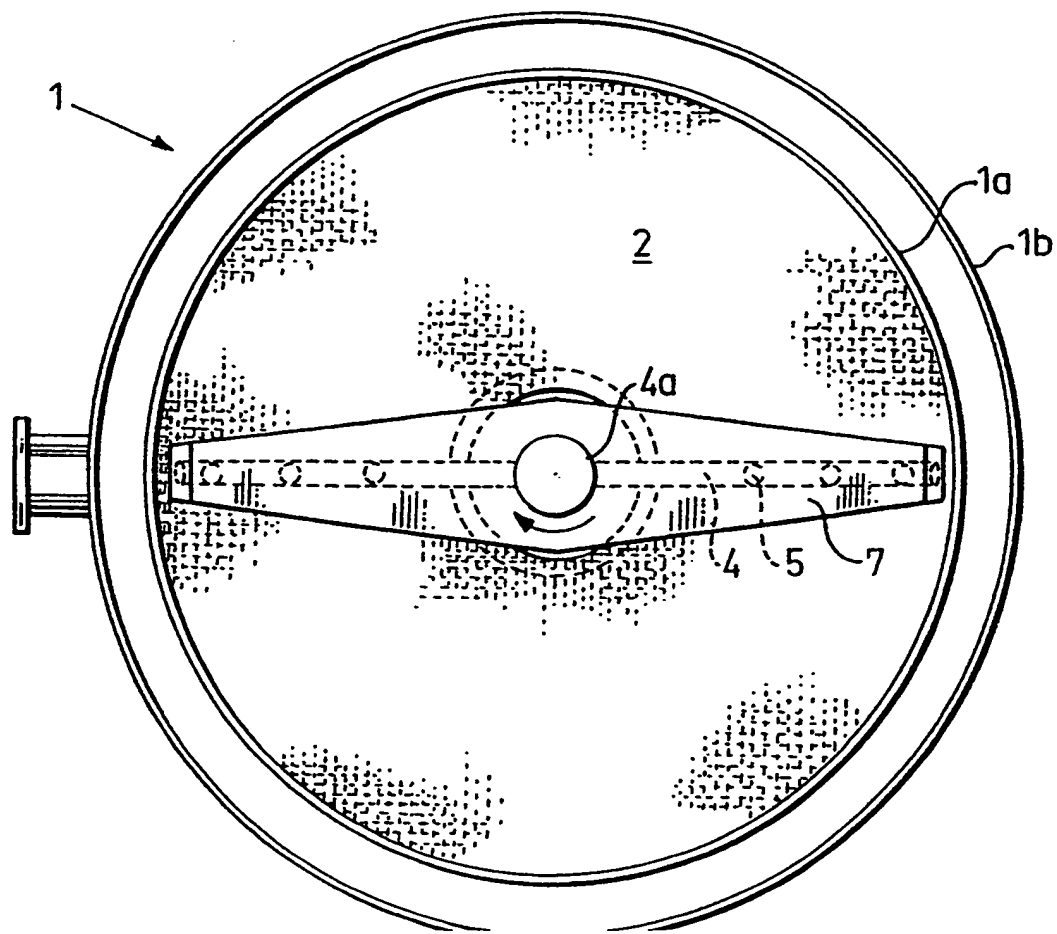


Fig. 3

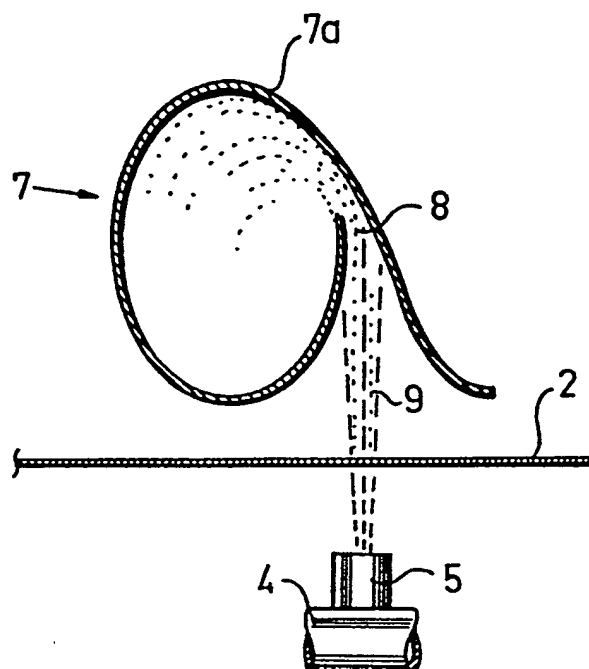
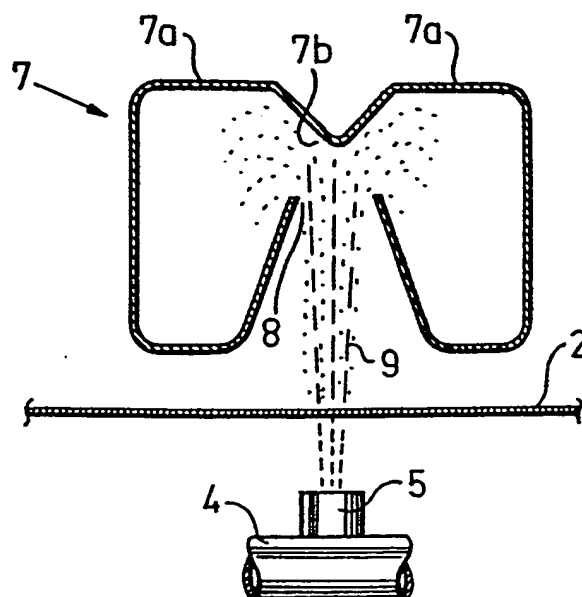
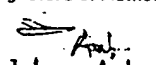
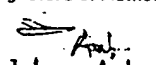
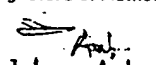


Fig. 4



INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 91/00158

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: B 01 D 29/68											
II. FIELDS SEARCHED <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched⁷</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; border-bottom: 1px solid black;">Classification System</td> <td style="border-bottom: 1px solid black;">Classification Symbols</td> </tr> <tr> <td style="height: 40px; vertical-align: bottom;">IPC5</td> <td style="height: 40px; vertical-align: bottom;">B 01 D</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched⁸</div> <p style="padding-top: 10px;">SE,DK,FI,NO classes as above</p>			Classification System	Classification Symbols	IPC5	B 01 D					
Classification System	Classification Symbols										
IPC5	B 01 D										
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border-bottom: 1px solid black;">Category *</th> <th style="width: 60%; border-bottom: 1px solid black;">Citation of Document,¹¹ with indication, where appropriate, of the relevant passages¹²</th> <th style="width: 30%; border-bottom: 1px solid black;">Relevant to Claim No.¹³</th> </tr> <tr> <td style="vertical-align: top; border-right: 1px solid black;">A</td> <td style="border-right: 1px solid black; padding: 5px;">SE, B, 389614 (A. ELLILÄ) 15 November 1976, see the whole document ---</td> <td style="border-right: 1px solid black;"></td> </tr> <tr> <td style="vertical-align: top; border-right: 1px solid black;">A</td> <td style="border-right: 1px solid black; padding: 5px;">SE, C, 153533 (HANDELSBOLAGET ENGSTRÖMS MEKANISKA VERKSTAD) 28 February 1956, see the whole document -- -----</td> <td style="border-right: 1px solid black;"></td> </tr> </table>			Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	A	SE, B, 389614 (A. ELLILÄ) 15 November 1976, see the whole document ---		A	SE, C, 153533 (HANDELSBOLAGET ENGSTRÖMS MEKANISKA VERKSTAD) 28 February 1956, see the whole document -- -----	
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special categories of cited documents:¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>											
IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black;">Date of the Actual Completion of the International Search</td> <td style="width: 50%; border-bottom: 1px solid black;">Date of Mailing of this International Search Report</td> </tr> <tr> <td style="border-bottom: 1px solid black;">16th April 1991</td> <td style="border-bottom: 1px solid black; text-align: center;">1991-05-23</td> </tr> <tr> <td style="border-bottom: 1px solid black;">International Searching Authority</td> <td style="border-bottom: 1px solid black;">Signature of Authorized Officer</td> </tr> <tr> <td style="text-align: center; padding-top: 20px;">SWEDISH PATENT OFFICE</td> <td style="text-align: center; padding-top: 20px;">  Johan Arhén </td> </tr> </table>			Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	16th April 1991	1991-05-23	International Searching Authority	Signature of Authorized Officer	SWEDISH PATENT OFFICE	 Johan Arhén	
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SWEDISH PATENT OFFICE	 Johan Arhén										

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.PCT/SE 91/00158**

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The members are as contained in the Swedish Patent Office EDP file on **91-03-23**
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE-B- 389614	76-11-15	CA-A- 1045046	78-12-26
		DE-A- 2446746	75-04-30
		FR-A-B- 2248866	75-05-23
		GB-A- 1468738	77-03-30
		JP-A- 50078961	75-06-27
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